International Journal of Structural and Civil Engineering Research

ISSN 2319 – 6009 www.ijscer.com
Vol. 4, No. 1, February 2015

Review Article

PUNE METRO RAIL PROJECT: A REVIEW

W N Deulkar[1] and A F Shaikh[2]*

*Corresponding author:**A F Shaikh** ✉ ayub24686@gmail.com

The increasing levels of congestion on Pune road network coupled with high private vehicle usage prompted the planners and the implementing agencies to go for transportation infrastructure improvements. The planners have realized the fact that there should be a phenomenal change in the existing transportation system that would investigate a substantial shift from Private vehicles to Public Transit. Thus a need for an appropriate Mass Transit system was felt and Delhi Metro Rail Corporation (DMRC) was entrusted with preparation of Detailed Project Report (DPR) for identifying the potential corridors for implementation of Metro Rail system in Pune. This paper critically reviews and analyzes the decision making systems behind the proposed Pune metro rail system and its detailed project report, and exposes many weaknesses in both. The decision making system is seen to be ad hoc, and not sufficiently transparent or participative. The detailed project report suffers from many serious methodological and analytical errors. This analysis and experience from other cities suggests that cities are increasingly seeking single large, big budget solutions to their urban transport problems without exploring the many simpler, cheaper and more effective options that are available.

Keywords: Mass Transit, Metro Rail, Infrastructure, DMRC, etc.

INTRODUCTION

In early 2010, Pune Municipal Corporation (PMC) approved a proposal to build a metro rail system in Pune based on a Detailed Project Report (DPR) prepared by the Delhi Metro Rail Corporation (DMRC) in 2009. The decision was taken despite of numerous concerns raised by many citizens groups and experts about various issues such as the choice of gauge and its impact on system cost, throughput, etc., financial burden sharing by citizens of Pune, impact of an over ground metro on the city's heritage and skyline, impact of the proposed routes on buildings in the city and impact of the proposed Floor Area Ratio (FAR) increase. In this paper, we critically analyze both the decision making process behind approving the metro rail proposal and the metro rail proposal itself. The analysis also leads to broader questions regarding planning and governance of urban transport in the country.

[1] Associate Professor, D Y Patil College of Engineering, Akurdi, Pune 411044, India.

[2] M.E. Student, D Y Patil College of Engineering, Akurdi, Pune 411044, India.

The proposal initially approved by PMC was for two corridors (I and II) of metro rail. Subsequently, due to a delay in arriving at an agreement with neighboring Pimpri Chinchwad regarding corridor I, PMC decided to proceed with corridor II which is entirely within its jurisdiction. Table 1 gives an overview of the proposed metro rail system (DMRC, 2009). The capital costs are exclusive of any taxes and based on September 2008 prices, and which come to about Rs. 226 cr per km. Proposed peak hour headways are about 3.5 to 4.5 min, and 8 to 12 min for corridor I and II, respectively. The ridership estimates are based on dense (or super crush) loading of 8 persons per sq.m. The DPR predicts that at this ridership and cost, the proposed metro rail will make a positive socioeconomic impact on Pune city.

DECISION MAKING PROCESSES BEHIND PUNE METRO RAIL

Reconstruction of the timeline of various events led to the approval of the metro rail proposal by the General Body of the PMC based on answers to a set of questions asked under the Right to Information Act. An analysis of these replies suggests that the DPR was commissioned within sufficient justification, the terms of reference for the DPR were weak and there were weaknesses in governance processes and engagement with citizens.

Ad-Hoc Decision Making and Weak Terms of Reference

PMC commissioned DMRC to prepare a DPR for metro rail based on the views expressed at two meetings involving city MLAs in June and September 2006, and a previous study by RITES (2001). But the scope of work given to RITES for its report was only to forecast the demand for a high capacity mass transport network and identify suitable corridors for it. Thus, the RITES report was also commissioned pursuing the need for a high capacity network rather than evaluating for its need. The other citation by DMRC is a guideline from the Ministry of Urban Development (MoUD) that all cities with a population of over 3 million should consider metro rails. However, the need for a metro rail is not dependent only on the city's population but also on city's form, presence of a central business, other road network, etc. (Mohan, 2008).

The terms of reference given to DMRC for the DPR only to identify suitable corridors for a metro rail system. Guidelines for mass transit clearly states that DPR should be part of an integrated, comprehensive plan, providing an analysis of alternatives, details of stakeholder consultations and details of feeder networks, parking and para transit facilities. Further, the 30 km length mentioned is to thought of as it appears to be of 22.5 km (RITES, 2001).

Table 1: Details of Proposed Metro Rail System (After DMRC 2009)

Corridor Details	Length (km)	Over Ground Stretch (km)	Estimated Cost (Rs cr)	Expected Daily Ridership		
				2011	2021	2031
I: PCMC to Swargate	16.5 km	11.5 km	4,911	348,387	397,228	443,849
II: Vanaz to Ramwadi	15 km	15 km	2,217	136,309	212,020	290,515

Therefore it is seen that the DPR for Pune's metro rail is commissioned based on some ad hoc recommendations and without any previous comprehensive multi modal study of Pune's transport justifying the need for a metro rail. Moreover, its terms of reference did not comply with the guidelines of MoUD and consequently the report submitted by DMRC did not consider alternatives, feeder services, etc.

Governance Processes

The governance processes adopted during the decision making for Pune's metro rail raise some following issues:

1. PMC put up the metro rail DPR on its website soon after it was received. However, it did not actively seek public participation inputs and initiate a public debate. In fact, the appendix to the letter from PMC to Government of Maharashtra requesting approval for implementing corridor II mentions that DMRC are proven experts regarding metro rail hence, their report needed no critical review by an independent committee (PMC, 2010).
2. Six months after the DPR was submitted, the Standing Committee of the PMC approved it in just one day based on a request from the Municipal Commissioner. Some members of the Standing Committee admitted later at a public meeting that they approved the DPR without even reading it and believing that, it was in the city's best interests.
3. PMC organized a 'public hearing' in June 2010 to understand citizen's grievances about the proposed metro rail. PMC's request to the Government of Maharashtra for seeking permission to proceed with corridor II claims that grievances raised at the hearing had been addressed satisfactorily (PMC, 2010). However, as the following examples from the appendix to the request shows the following dissatisfaction

a. It states that previous studies like the Comprehensive Mobility Plan (CMP) were studied to finalize routes for the metro rail in the CMP, though the CMP was commissioned *after* the metro rail DPR. Indeed, the metro rail DPR does not even mention the CMP, while the CMP refers to the DPR clearly pointing to their relative chronology.

b. It states that the viability of the project would be ensured by private funders who may fund 50% of the project cost. Such a statement coming from a authority like the PMC is of concern and displays a lack of understanding of the distinction between financial viability of a project and its social desirability. Given that fare box revenues will not be sufficient for a reasonable return on investment, investors would necessarily depend on Government support in the form of viability gap funding, free or subsidized land, tax concessions, etc.

c. It states that improvement and strengthening of Pune Municipal and Pimpri Municipal ltd. (PMPML) the bus service is continuing in parallel though PMPML had a full time CMD for over a year and many posts on its Board of Directors have been vacant.

d. It states that the plan prepared by DMRC is a comprehensive transport plan though

PMC's own terms of reference to DMRC clearly state that its job was only to identify approximately 30 km of metro rail along feasible corridors.

4. PMC agreed to extend the proposed corridor II to the current airport and Kharadi, subject to demand, finance, etc. These extensions seem arbitrary as there are no studies to justify them, particularly when a new airport has also been proposed for Pune.
5. PMC approved an FAR increase by 4, stating that it was required to increase metro rail ridership and to raise finances for it. However, the DPR predicts a dense load of 8 persons per sq.m with the current land use pattern, suggesting that corridor densification is not required for the desired ridership. DPR states that only 6% of total revenue is expected from property development and FAR increase is not critical to finance the metro rail. This raises doubts about the true motives for the proposed FAR increase.

CRITIQUE OF PUNE METRO RAIL DPR

In addition to *ad hoc* decision making, weak governance and inadequate public engagement analysis identifies shortcomings with these include methodological errors and over estimation of the benefits from the metro rail which are then used to demonstrate that it has a positive social impact. The clarification on many of the points were requested.

Methodological Problems

The methodological problems in DPR submitted by DMRC are listed below.

1. DMRC commissioned a report from IIT Bombay to project ridership along potential of metro rail corridors (IIT Bombay, 2008). To do this, IIT Bombay used a 'stated preference survey' asking citizens for their preferred mode of public transport from among various alternatives. Surveys were carefully designed as it can introduce a bias in a respondent's answer. But the IIT Bombay survey used a leaflet, states that Pune's metro will provide "cost of travel comparable to bus fare, trains will run at convenient frequency of 3 min during peak hours and comfortable sitting in A/C environment". None of these claims holds true in the DPR. Therefore, the ridership figures were estimated from a deeply flawed consumer survey, which advertised a service that was very different from the service that was actually designed.
2. The commuter survey also asked respondents to choose between the proposed metro rail and current frequencies and capacities of existing modes. This ignores the possibility that frequencies and performances of both the existing bus system and suburban rail system can be significantly improved at a fraction of the cost and time required for the metro rail. In other words, the metro travel demand was forecasted by comparing an ideal yet to be implemented metro rail with the current state of other neglected and under funded public transport services.
3. Public transport modes such as the metro rail are considered desirable because they can win people away from private vehicles. For this, various public transport modes must complement each other and not

compete. But, the DPR is silent about integrating the metro rail with other public transport modes. In fact, the two proposed corridors compete with the proposed BRT and existing suburban rail along their entire length.

In addition to these methodological errors, the report also contains many data anomalies and inconsistencies which raise more questions about the DPR.

Cost-Benefit Analysis

One of the key justifications given by the DPR for its proposal is a socioeconomic cost benefit analysis which shows that the socioeconomic benefit of the project outweighs its costs. The costs considered in the DPR are the capital and operational costs, while societal benefits are said to arise from various categories such as savings in time, fuel, vehicle maintenance cost and infrastructure maintenance cost. It is questionable that how much productive use can be made of the few minutes saved per trip by a person, and whether items such as reduced vehicle maintenance costs should even be considered. Moreover, the costs considered in the DPR do not include costs such as the cost of capital.

Even if we overlook these discrepancies, the cost benefit analysis given in the DPR is flawed. The DPR estimates total benefits to society from the metro rail in 3 horizon years – 2011, 2021 and 2031. It is seen that the benefit claimed for 2011 is vastly over estimated – the same analysis also applies to the other years. Analysis of the three categories (time savings, vehicle maintenance savings and fuel savings) with the largest claimed benefits and provide alternative estimates using data from the DPR itself such as trip length distribution and metro rail ridership, augmented with a set of conservative assumptions such as fuel cost of Rs. 60/L, average mileage of 45 kmpl and annual maintenance cost of Rs. 3000 for two wheelers, and 10 kmpl and Rs. 15000 for cars. Other assumptions made are explained at appropriate locations below.

Time Savings

DPR, the benefit of value of time saved by shifting to metro rail from other modes. Each metro rail trip is estimated to save 45 min in 2011 and the claimed money equivalent savings of the aggregate annual time saved adds up to 56% (Rs. 524 cr) of the total claims annual benefit (Rs. 934 cr). This includes not only time saved in travel but also the walking and waiting time for one's transport and money/time equivalent of factors such as travel comfort.

Many reports, including a study commissioned by DMRC, state that Pune's average peak hour road speed is about 20 25 kmph, while the speed of the proposed metro rail is 33 kmph [10, 11, 3, 2]. The DPR also states that 75% of journeys are shorter than 9 km. Assuming an average speed of 20 kmph for other modes, 75% of journeys would take a maximum of 27 min by other modes and 16 min by metro rail. Therefore, the travel time saving is just 11 min for 75% of the journeys.

Metro rail users who have shifted from two wheelers or cars would not save any time in walking to the metro rail station and waiting for a train – in fact, they would lose time. Given that peak hour ridership estimated for the

metro rail is based on dense loads of 8 persons per sq. m, they would also not gain anything from added travel comfort. Therefore, the maximum saving for all such metro rail users would be at most 11 min over 75% of journeys, with actual savings even lower due to reduced time savings and comfort.

Users who have shifted from buses could perhaps have some time equivalent saving due to higher waiting times and discomfort factors, though their walking times are likely to increase since bus stops are likely to be closer to homes and offices than metro rail stations. Even the higher waiting time and discomfort factors are questionable because: a) peak hour headway of the proposed metro rail corridors is only 4 and 8 min in 2031, which a bus system can easily match and b) the metro rail is designed for dense loads of 8 persons per sq. m which is comparable to buses at peak hour. Even if we conservatively assume that all bus users pay a penalty of 15 min per trip (10 min for waiting and 5 min for discomfort), 75% of bus users switching to metro rail would have a time equivalent saving of only 26 min as their journeys would be less than 9 km.

It is obvious that the time savings component presented in the DPR is vastly over stated. A detailed analysis (see Section 3.2.4) shows that even if all the metro rail trips by users who switched from buses (thus providing maximum time savings), the total time savings in 2011 comes only to Rs. 273 cr against the claimed Rs. 524 cr savings.

Fuel Savings

The DPR estimates fuel savings of Rs. 123 cr savings in 2011 by considering a modal shift to metro rail from other modes. This does not account for behavioral changes such as induced travel and longer commutes that may result because of the introduction of a metro rail system. Even if one ignores such oversights, the claimed benefits in this category are still over estimated.

Based on the assumed fuel efficiencies for two wheelers and cars, and actual bus fares projected for 2011, estimates show that fuel savings are only to the tune of Rs. 37 cr (30% of claimed benefit) under a reasonable scenario of 35% of metro rail users switching from buses, 40% from two wheelers and 25% from cars. It is only in a scenario where about 65% of the metro rail users switch from cars (thus providing the greatest fuel savings), that the estimated fuel saving come close to the claimed saving. But note that such a metro rail usage pattern would greatly reduce time savings.

Vehicle Maintenance Savings

The second highest category of claimed savings (Rs. 161 cr in 2011) comes from savings in vehicle maintenance costs. Using assumption of a 50% reduction in vehicle maintenance cost of persons switching to the metro rail from their vehicles, the estimated savings in this category is only Rs. 60 cr in 2011 (37% of the claimed benefit) when 35% of metro rail users come from buses, 40% from two wheelers and 25% from cars. The claimed savings become possible only when about 85% of metro rail users have shifted from cars. Note once again that such a share of shifts from cars greatly decreases time savings.

Benefit Comparison

The different possible ridership scenarios for

the proposed metro rail and estimate likely benefits in 2011 are compared against the benefits claimed by the DPR. Each scenario represents a particular combination of shifts from buses, two wheelers and cars to metro rail and benefits under these scenarios are calculated using the DPR's methodology in spite of reservations about it.

Figure 1 presents the benefit under different scenarios. The DMRC scenario represents the benefit claimed in the DPR. The 0-0-100 and 100-0-0 scenarios represent the extreme scenarios where all metro rail users come from either cars or buses respectively, and correspond to the maximum overall estimated benefit and maximum benefit from time saved. This is followed by six scenarios, each representing a 'reasonable' modal shift. As can be seen, the estimated benefit in all scenarios is considerably lower than claimed in the DPR. The highest estimated benefit is in the extremely unrealistic 0-0-100 scenario which is also 36% lower than claimed. The estimated savings in all other scenarios (including the 100-0-0 scenario) is only about 40% of the claimed savings, thus establishing that the benefits claimed in the DPR are highly exaggerated.

Figure 1: Estimated Savings Under Various Scenarios of Shifts

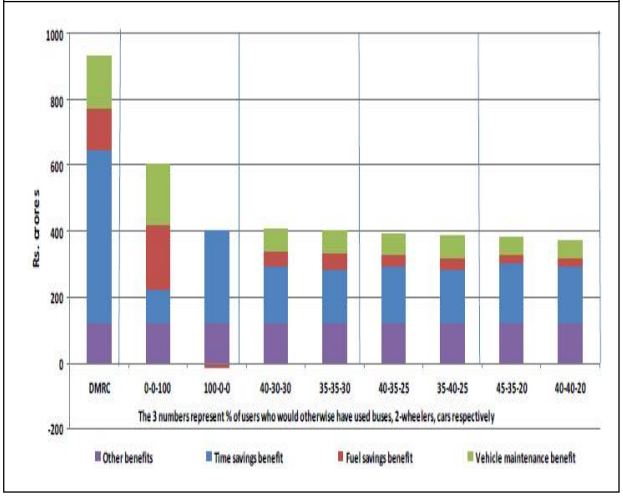
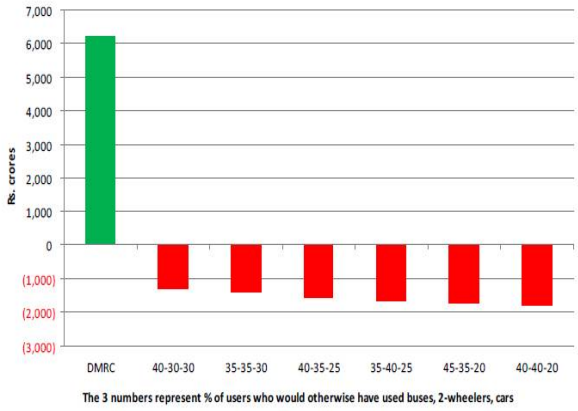


Figure 2: NPV of DMRC DPR Under the Different Scenarios at 12% Discount Rate



Desirability of the Metro Rail System

Based on the presented cost and benefit flows, the DPR concludes that the proposed project has an overall socioeconomic return of about +5% at a 12% discount rate, and hence it is good for the city. Figure 2 shows the socioeconomic NPV of the metro rail (also at 12% discount rate) using our benefit estimates and the costs given in the DPR under different scenarios. As can be seen, the proposed metro rail has a negative socioeconomic NPV in all scenarios in spite of conservative assumptions. Issues such as not achieving the projected ridership as seems likely are not considered (Mohan, 2008). This raises serious questions about the DPR and implementation of the proposed metro rail for Pune.

CAG (2008) given the serious flaws in the DPR suggested it should be critically reviewed by the Government of Maharashtra and Government of India. In addition, the Delhi metro's under achievement of ridership and questions asked about its accountability and

governance by the Comptroller and Auditor General strongly indicate that DMRC project reports must not accepted on faith by city administrations.

CONCLUSION

Indian cities, with the help of DMRC, are planning to invest about Rs. 2 tn in metro rail systems. But our analysis shows that the DPR prepared by DMRC for Pune has many serious analytical and methodological flaws, making the proposal highly questionable. Therefore, there is an urgent need to revisit all proposed metro rail projects and critically review them. An independent expert group should conduct the review based on clear, objective criteria and examine all aspects such as their justification, governance, accountability, viability and integration with other modes, and the review findings should be publicly debated.

India is urbanizing rapidly but its urban governance institutions, systems and capacities have not kept pace. This gives rise to the problems presented above, resulting in big, expensive projects that often do not deliver the promised benefits and neglect of cheaper, quicker alternatives that may be more beneficial. This needs to be addressed urgently. ULBs must be reformed to make them transparent and directly accountable to citizens, and undertake integrated, comprehensive, least cost planning considering supply and demand side options. Otherwise, it is very likely that there would be large investment in urban transport projects with very little benefits, and our cities will grow increasingly grid locked and unlivable. In turn, this could well put the brakes on the country's much touted economic growth story.

REFERENCES

1. CAG (2008), "Performance audit of phase I of Delhi Mass Rapid Transit System by Delhi Metro Rail Corporation", Comptroller and Auditor General of India, Report 17 of 2008
2. DMRC 2009, "Detailed Project Report for Pune Metro", Delhi Metro Rail Corporation.
3. IIT Bombay (2008), "Traffic forecast for the proposed metro rail project in Pune metropolitan area, Transportation systems engineering group", Department of Civil Engineering, IIT Bombay, March 2008.
4. Mohan D (2008), "Mythologies, metro rail systems and future urban transport", *Economic and Political Weekly*, January 26, 2008
5. Parisar (2010), *City and the Metro,* Proceedings of a national round table, Parisar, July.
6. PMC (2010), Letter dated 28th June 2010 from Pune Municipal Corporation to Government of Maharasthra requesting approval of corridor II of the proposed Pune metro.
7. Ramachandraiah C (2009), "Maytas, Hyderabad metro and the politics of real estate", *Economic and Political Weekly,* Jan 17, 2009
8. RITES (2001), *Mass Rapid Transit System for Pune Metropolitan Area*, RITES Ltd., Jan 2001.
9. Various (2010), "Letters, questions and petitions submitted to PMC by citizens

groups such as the Pune Metro Jagruti Abhiyan and Pune Technical Coalition", 2010

10. WSA (2008a), "Comprehensive Mobility Plan for Pune City, Wilbur Smith Associates", IL&FS Urban Infrastructure Services Ltd., 2008

11. WSA (2008b), "Study on traffic and transportation policies and strategies in Urban areas in India commissioned by the Ministry of Urban Development (Government of India)", Wilbur Smith Associates, May 2008.